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A BACTERIAL DISEASE OF THE PEACH*

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From time to time during the past five or six years peach growers in various sections of the country have called attention to a shot-hole disease of peach leaves which, in wet seasons at least, has caused a great deal of premature defoliation. In 1903 Mr. P. J. O'Gara, of the Bureau of Plant Industry, found it prevalent in Georgia and suggested that it was of bacterial origin. During the same season Clinton* observed a leaf-spot disease, evidently the same, in Connecticut, and noted it in his report for that year.†

It was again found in Georgia in 1905 by Mr. W. M. Scott, of the Department of Agriculture. In 1906, 1907, and also in the past season the writer, who undertook a somewhat detailed study of the disease found it to be prevalent throughout the South and Middle West, and, in those sections at least, it is the commonest shot-hole disease of peach leaves, the Cercospora leaf-spot being but rarely met with. That a bacterium caused the disease was proved by inoculation experiments. A bacterial disease of peach twigs and of the fruit was also found, and it seems probable that they, as well as the leaf-spot, are caused by the organism in question.

The form occurring on the leaves is by far the commonest and most wide spread. It causes somewhat angular, purplish-brown spots ⅛ to ¼ inch in diameter which, when infections have been numerous, coalesce so that quite large areas of the leaf may be involved. The diseased tissues soon fall out, giving a shot-hole effect. Leaves which are at all badly affected soon drop to the ground, so that the trees may become prematurely defoliated. This is especially true in orchards which have not been well pruned and cultivated.

In August, 1906, very small spots from fresh leaves were cut out, thoroughly washed, and then mashed up in sterile water, from which, by the poured-plate method, a yellow motile organism was isolated. Many of the plates proved to be pure cultures containing sometimes 100 or 200 colonies.

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* Paper read at the meeting of Section G, A. A. A. S., Baltimore, 1908.

† Rep. Conn. Agric. Exp. Sta. 26: 337. 1903.

During the summer of 1907, a series of successful inoculations with this bacterium was made at Bentonville, Arkansas. Sterile water was added to pure cultures on slant agar five days old and with a sterile needle the bacterial growth was loosened from the surface of the medium and thoroughly mixed with the water. This liquid, containing bacteria in great numbers, was diluted a little and then sprayed with an atomizer on young Elberta peach leaves. This variety was chosen because it is naturally quite susceptible to the disease. Three sets of inoculations were made on different days and on different trees. From thirty to forty leaves were involved in each spraying. About an equal number of leaves on adjacent trees were sprayed with sterile water alone to serve as a check. The inoculations were made on June 25, 26 and 28. The trees inoculated on the two earlier dates were examined on July 15. From four to six spots of the characteristic appearance were found on most of the leaves which had been sprayed with the bacteria-bearing fluid, while the leaves sprayed with sterile water showed no spots at all. The leaves inoculated on June 28 were examined on July 20, and, as in the previous cases, the leaves which had been sprayed with the bacteria showed spots, three or four to a leaf, while the checks remained free. Sections of these spots on the inoculated leaves, when examined under the microscope, showed the characteristic cavities filled with bacteria and plates poured from the smallest spots were practically pure cultures of one organism, the motile yellow bacterium with which the inoculations had been made. Although in no case were the spots on the leaves as numerous as one might expect considering the large number of bacteria in the fluid used, the fewness of the spots may be accounted for by the fact that the weather conditions at the time were very unfavorable, there being scarcely any rainfall and but little dew, and no attempt whatever was made to keep the leaves moist after the inoculations were made. From these experiments the conclusion may be drawn that this disease of peach leaves is caused by the yellow bacterium.

The disease as it occurs on the twigs was first observed by the writer at Siloam Springs, Arkansas, in 1907. It kills the bark of young shoots, forming purplish-black, slightly sunken areas usually ⅛ to $^3/_{16}$ inch wide which may extend for two or three inches along the stem or even girdle it. At times the whole end of a shoot may be killed. The infections as a rule seem to take place at a leaf scar. The disease was found again last year in an orchard at Bentonville, Arkansas. In each case it was closely associated with the bacterial leaf-spot; in fact many of the diseased twigs had already been defoliated. Sections through the smallest spots showed that bacteria were present in enormous quantities in cavities in the bast tissue, and by the poured-plate method a yellow bacterium was isolated from these spots. The growth of this organism in various media, such as beef, rice and corn-meal agar and on potato cylinders, is similar to that of the organism isolated from the leaf-spots and the two organisms are evidently the same. No attempt has yet been made to produce the disease on the twigs by inoculation.

The disease as it occurs on the fruit is quite striking and exceedingly characteristic. It was found in two orchards at Bentonville during the past season. It causes a very small purplish spot over which the skin soon cracks either in a straight or angular way. The individual spots are scarcely ever much over $^1/_{16}$ of an inch in diameter but are usually very numerous (as many as 250 have been counted on one side of a peach), so that the cracks may become continuous and extend for an inch or more. Numerous sections through even the smallest of these spots showed that bacteria were present in enormous quantities and were evidently the cause of the trouble. Attempts to get pure cultures of the organism were not successful because of the cracks and the small size of the spots which made it impossible to sterilize the outside of the peach without killing the parasite, and when plates were poured from spots which had not been sterilized on the outside they became completely overrun with rapidly growing saprophytes. The reasons for assuming that the organism isolated from the leaf-spot and the stem-spot is also responsible for this fruit-spot will be pointed out later.

As to the identity of the organism causing the leaf-spots there does not seem to be much doubt. Soon after the peach leaf-spots were first found, Dr. Erwin Smith suggested to the writer that *Bacterium pruni,* the organism causing the bacterial black-spot of plums and a plum leaf-spot, was the cause, and though this as yet has not been completely proved, all the work that has been done points to the truth of that suggestion. In the first place the hosts are closely related and have other diseases in common; then too the microscopic and macroscopic appearance of the peach leaf-spots is identical with that of the bacterial plum leaf-spots. For the past three months the organism isolated originally from peach leaf-spots and *Bacterium pruni* isolated from plum spots, have been grown side by side in different culture media, such as beef bouillon, nitrate bouillon, Uschinsky and Dunham solution, gelatin, beef agar, milk, litmus milk, and potato cylinders and in all the cultural characteristics are exactly the same. Finally, by inoculating with *Bacterium pruni,* spots may be produced on peach leaves similar in all respects to those resulting from natural infection and from artificial infection with the organism isolated from natural infection spots on the peach.* The only thing necessary to complete the chain is to produce the plum spots with the organism isolated from the peach leaf-spot.

Though the twig-spots have not yet been produced by inoculation the organism isolated from them has all the cultural characteristics of the leaf-spot organism so that it also may be considered to be *Bacterium pruni.*

As the fruit-spot was not discovered until the end of the peach season last year but little work has been done on it. Attention is called to it here because of its bacterial nature and its very characteristic appearance. It has not been produced by inoculation nor has the organism been isolated, but the spots are so strikingly similar in both microscopic and macroscopic appearance to the young bacterial spots on the plum, especially those resulting from late infections, that it may be safely assumed that *Bacterium pruni* is the cause of this disease also.

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* In a paper entitled "Occurrence of *Bacterium pruni* on Peach Leaves," read before the Society of American Bacteriologists at the Baltimore meeting, Dr. Erwin F. Smith reported the results of inoculations with *Bacterium pruni* on peach leaves made in 1907–1908, which agree in every respect with those obtained by the writer.

The writer is planning to continue the investigation of these diseases through another season in order to establish more definitely their relationship.

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